AKULOV, I.I.; BARZHIN, V.Ya.; VALITOV, R.A.; GARMASH, Ye.N.; KUCHIN, L.F.; MAYDEROV, V.Z.; PUTSENKO, V.V.; SEMENOVSKIY, V.K.; SIMONOV, Yu.L.; TARASOV, V.L.; TEREKHOV, N.K.; SHEVYRTALOV, Yu.B.; YUNDENKO, I.N.; CHISTYAKOV, N.I., prof., otv. red.; KOKOSOV, L.V., red.

[Theory and design of basic radio circuits using transistors] Teoriia i raschet osnovnykh radiotekhnicheskikh skhem na tranzistorakh. Moskva, Svinz', 1964. 454 p. (MIRA 18:8)

KUCHIN, M.

Let us meet the spring fully prepared. MTS 14 no.3:18-20 Mr '54.
(MLRA 7:4)

1. Direktor Cherepovetskoy mashino-traktornoy stantsii, Vologodskoy oblasti.
(Machine-tractor stations)

Translation from: Referativnyy zhurnal, Geografiya, 1957, Nr 7, p 104 (USSR) 14-57-7-14858

AUTHOR: Kuchin, M. I.

TITLE: Types of Water-Collecting Systems Used by Industry and for Water-Supply in Western Siberia (Tipy vodozaborov, vstrechayushchikhsya v praktike promyshlennogo i khozyaystvenno-bytovogo vodosnabzheniya v Zapadnoy Sibiri)

PERIODICAL: Sb. nauch. tr. Tomskiy inzh.-stroit. in-t, 1956, Vol 1, pp 66-81

ABSTRACT: New types of water-collecting systems had to be adopted in Western Siberia because of certain hydrological peculiarities of the rivers (intensive formation of sludge ice, heavy turbidity especially typical during high water stages, and the contribution of suspended matter by runoff waters). A surface type

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Types of Water Collecting Systems (Cont.) 14-57-7-14858

reservoir, built in the Novosibirsk district, uses for a natural sedimentation basin an abandoned river channel which formerly collected alluvial ground waters. To provide Stalinsk with water, an infiltrational system was constructed. It consists of a horizontal gallery, the axis of which was at a distance of 80 m from the shore of the Tom' River. The sand and gravel deposits along the river shore serve as filters. Infiltrational systems are sometimes used together with surface systems in some parts of the Minusinsk depression. Infiltration water from the river is used during the warm season of the year; in the winter months surface water resources are exploited. The author also describes exploitation of water from flowing artesian wells and from the wells draining deep ground water reservoirs.

Card 2/2

G. D.

Translation from: Referativnyy zhurnal, Mekhanika, 1958, Nr 2, p 97 (USSR) SOV/124-58-2-2189

AUTHOR: Kuchin, M. I.

TITLE: Comparative Characteristics of Extant Methods for the Evaluation of the Stability of Structures and the Calculation of Settlement (Sravnitel'nyye kharakteristiki imeyushchikhsya sposobov otsenki ustoychivosti sooruzheniya i rascheta osadok)

PERIODICAL: Sb. nauchn. tr. Tomskiy inzh.-stroit. in-t, 1957, Vol 2, pp 3-30

ABSTRACT: Bibliographic entry

Card 1/1

KUCHIN, M.I., prof., otv. red.; MORDOVINA, L.G., tekhn. red.

[Megascopic determination of rocks and study of their physical characteristics] Makroskopicheskoe opredelenie gornykh porod i izuchenie osnovnykh ikh fizicheskikh kharakteristik; uchebnoe posobie dlia studentov spetsial'nostei "Promyshlennoe i grazhdanskoe stroitel'stvo" "Dorozhnoe stroitel'stvo" inzhenerno-stroitel'nykh institutov. Tomsk, Izd-vo Tomskogo univ. Pt.1. 1960. 54 p. (MIRA 14:10)

1. Tomsk. Inzhenerno-stroitel'nyy institut.
(Rocks--Testing)

BELOUS, L.Kh., st. nauchn. sotr.; KAZANSKIY, Yu.P.; VDOVIN, V.V.; KLYAROVSKIY, V.M.; KUZNETSOV, V.P.; NIKOLAYEVA, I.V.; NOVOZHILOV, V.I.; SENDERZON, E.M.; AKAYEV, M.S.; BABIN, A.A.; BERDNIKOV, A.P.; GORYUKHIN, Ye.Ya.; NAGORSKIY, M.P.; PIVEN', N.M.; BAKANOV, G.Ye.; GEBLER, I.V.; SMOLYANINOV, N.M.; SMOLYANINOVA, S.I.; YUSHIN, V.I., D'YAKONOVA, N.D.; REZAPOV, N.N.; KASHTANOV, V.A.; GOL'BERT, A.V.; SILOKOV, A.P.; GARBASH, A.A.; BYKOV, M.S.; BORODIN, L.V.; RYCHKOV, L.F.; KUCHIN, M.I.; SHAKHOV, F.N., glav. red.; SHIAKOVSKAYA, L.I., red.

[West Siberian iron ore basin] Zapadno-Sibirskii zhelezorudnyi bassein. Novosibirsk, Red.-izd. otdel Sibirskogo otdniia AN SSSR, 1964. 447 p. (MIRA 17:12)

1. Akademiya nauk SSSR. Sibirskoye otdeleniye. Institut geologii i geofiziki. 2. Institut geologii i geofiziki Sibirskogo otdeleniya AN SSSR (for Belous, Kazanskiy, Vdovin, Klyarovskiy, Kuznetsov, Nikolayeva, Novozhilov, Senderzon). 3. Institut gornogo dela (for Akayev). 4. Novosibirskoye geologicheskoye upravleniye Ministerstva geologii i okhrany nedr SSSR (for Babin, Berdnikov, Goryukhin, Nagorskiy, Piven').

(Continued on next card)

BELOUS, N.Kh.---(continued). Card 2.

Tomskiy politekhnicheskiy institut (for Bakanov, Gebler, Smolyaninov, Smolyaninova). 5. Sibirskiy nauchno-issledovatel'skiy institut geologii, geofiziki i mineral'nogo syr'ya(for Yushin, D'yakonova, Rezapov, Kashtanov, Gol'bert). 6. Institut ekonomiki sel'skogo khozyaystva (for Garmash). 7. Sibirskiy metallurgicheskiy institut (for Bykov, Borodin, Ryshkov). 8. Tomskiy inzhenerno-stroitel'nyy institut (for Kuchin). 9. Chlen-korrespondent AN SSSR (for Shakhov).

KUCHIN, Nikolay Dmitriyevich; MAYSHEVA, Nataliya Ivanovna; GADZHINSKAYA, Mariam Aleksandrovna; DENISOVA, Galina Ivanovna; TERPIGOREVA, V.D., otvetstvennyy redaktor; ALADOVA, Ye.I., tekhnicheskiy redaktor

English for miners. Pod red V.D. Terpigorevoi. Moskva, Ugletekhizdat, 1956. 507 p. (MLRA 10:4)
(English language--Textbooks for foreigners--Russian)
(Coal mines and mining)

TERPIGOREVA, Vera Dmitriyevna; KUCHIN, Nikolay Dmitriyevich; MAYSHEVA, Natal'ya Ivanovna; ARAKIN, V.D., dots., red.; GADZHIYSKAYA, M.A., red.izd-va; ALADOVA, Ye.I., tekhn.red.

English for mining students. Pod metodicheskoi red. V.D.Arakina. Moskva, Ugletekhizdat, 1957. 462 p. (MIRA 11:4)
(Coal mines and mining)
(English language--Textbooks for foreigners--Russia)

KUSHIN, N. N.

"The Utilization of a Tincture of the Crataegus 'Sonorskiy' Flowers for Treating Rheumatism Patients." Cand Med Sci, Kazakh State Medical Inst imeni V. M. Molotov, Alma-Ata, 1955. (KL, No 15, Apr 55)

SO: Sum. No. 704, 2 Nov 55 - Survey of Scientific and Technical Dissertations Defended at USSR Higher Educational Institutions (16).

VELIKANOV, I.I.; KUCHIN, N.N.

The theory of health resort therapy. Trudy Inst.Kraev. pat. AN Kazakh SSR 5:166-171 '57. (MIRA 11:2)
(HEALTH RESORTS, WATERING PLACES, ETC.)

SATPAYEVA, R.A.; KUCHIN, N.N.

S.P.Botkin as the initiator of the physiological trend in medicine.
Vest.AN Kazakh.SSR 13 no.9:124-126 S '57. (MIRA 10:10)
(BOTKIN, SERGEI PETROVICH, 1832-1889)

RESHETNIKOVA, Ye.K.; KUCHIN, N.N.

Outbreak of food poisoning of obscure etiology. Vop.pit. 19 no.4:24-27 Jl-Ag '60. (MIRA 13:11)

1. Iz Kazakhskogo instituta epidemiologii, mikrobiologii i gigiyeny i iz kafedry gospital'noy terapii Kazakhskogo meditsinskogo instituta, Alma-Ata.
(FOOD POISONING)

ISMAGULOV, A.S.; KUCHIN, N.N.

Size of an electrical systole in hypertension. Izv. AN Kazakh. SSR. Ser. med. i fiziol. no.1:100-104 '61. (MIRA 15:4)
(HYPERTENSION) (ELECTROCARDIOGRAPHY)
(HEART BEAT)

KUCHIN, N.

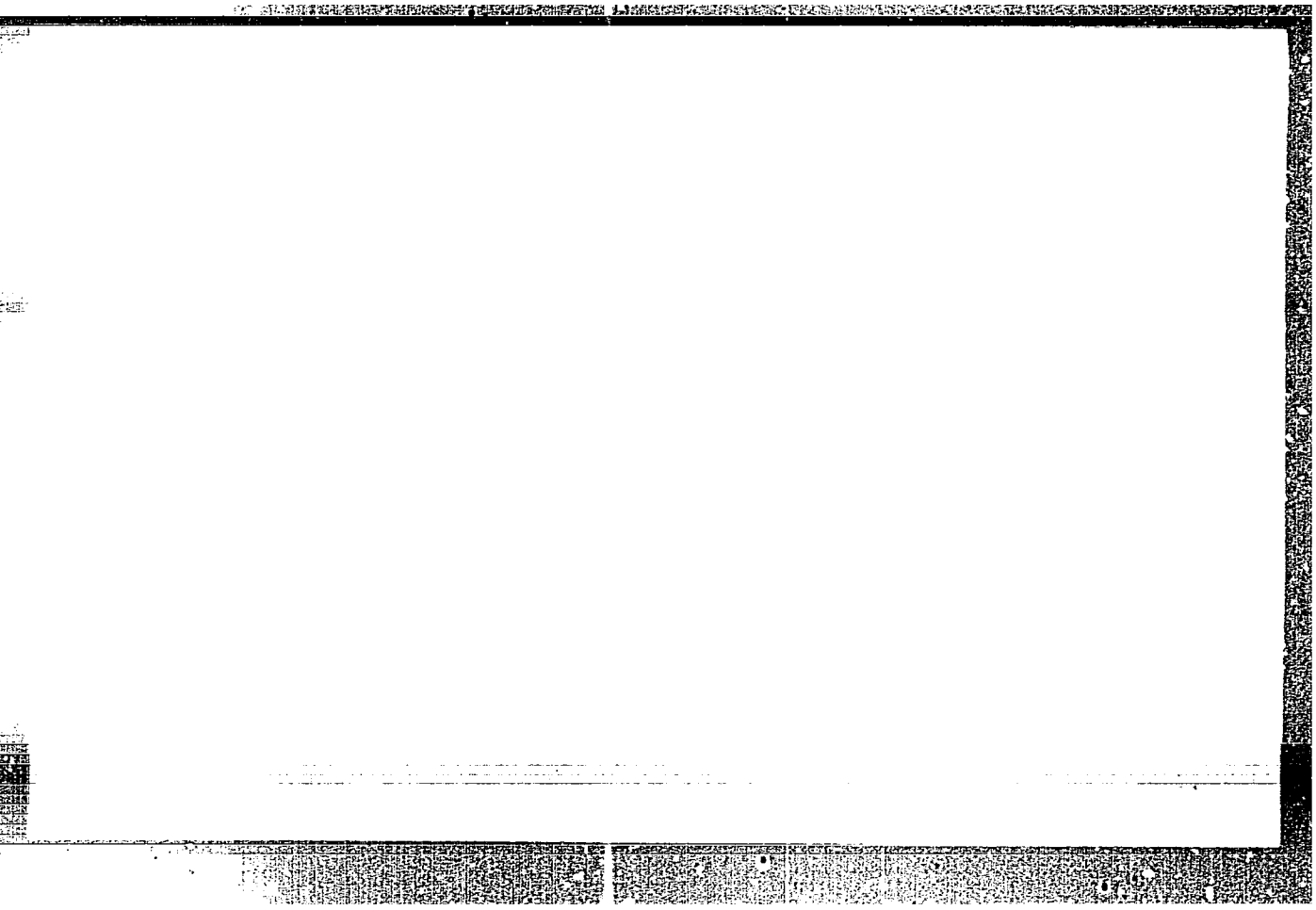
Twelfth Scientific Conference of the Therapeutic Institute of the Academy of Medical Sciences of the U.S.S.R. Zdrav. Kazakh. 21 no.5: 71-73 '61. (MIRA 15:2)

(CARDIOVASCULAR SYSTEM--DISEASES)

KUCHIN, N.N.

Very simple device for determining the rate of pulse wave spreading. Zdrav. Kazakh. 22 no.5:66-68 '62. (MIRA 15:6)

1. Iz kafedry gospital'noy terapii (zav. - prof. R.A. Satpayeva) Kazakhskogo meditsinskogo instituta.
(PULSE)
(CARDIOLOGY--EQUIPMENT AND SUPPLIES)



APPROVED FOR RELEASE: 06/19/2000 CIA-RDP86-00513R000827110009-3"

S/137/61/000/003/002/069
A006/A101

AUTHOR: Kuchin, V.A.

TITLE: A new method of fuelling steelmelting furnaces with natural gas

PERIODICAL: Referativnyy zhurnal. Metallurgiya, no. 3, 1961, 29-30, abstract 3V213 ("Sb. nauchn. tr. Gos. n.-i. i proyektn. in-t metallurg. promsti "Giprostal'", 1960, no. 1, 89 - 97)

TEXT: The fuel and air feed to an open hearth furnace through the roof not only excludes the necessity of carburizing the natural-gas flame but also assures considerably increased heat transfer to the pool as compared to heat transfer from a flat luminous tongue of flame. In case of feeding the fuel vertically through the roof, the tongue of flame is directly pointing to the pool. Due to the considerably greater turbulence of the gas flow with air, the combustion process is developing on a shorter way from the roof to the pool. The thermal stress of the flame volume is much higher than in the case of a flat tongue of flame. The temperature of the flame is higher too. If the burners are arranged in the roof of the furnace, the O_2 feed to the flame and for blowing through the metal pool is improved. The shortening of the vertical tongue of flame, due to O_2,

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A new method of fuelling steelmelting furnaces ... S/137/61/000/003/002/069
A006/A101

is fully utilized. Investigations in the Giprostal' laboratory showed the advantage of arranging the burners vertically in the roof over a horizontal arrangement on the rear wall and an inclined one in the operational space butt. Investigations were made on a special stand whose fire chamber represented a model of the operational space of a 70-ton open hearth furnace on a 1/10 scale of its natural size. The design of the stand and the investigation methods are described. The experiments were performed for each arrangement of the burners by three variants of heat conditions differing by the fuel consumption; for each experiment a heat balance was drawn-up. Experimental data for the plotting of heat balances are given. It was established that steelmelting is possible in a furnace heated by burners which are vertically arranged in the roof, with simultaneously increasing the efficiency of the furnace. Since all the heats were analyzed, it was proved that the technological process with the described method of heating the pool can be fully controlled. Schematic diagrams are given for the thermal operation of a furnace, heated with natural gas supplied from the roof, and a diagram for the conversion of a furnace, previously fuelled with coke-blast gas, to natural gas fuelling.

V.O.

[Abstracter's note: Complete translation.]

Card 2/2

KUCHIN, V. A.

Cand Tech Sci - (diss) "Study of aerodynamics and heat transfer in direct-flow-regenerative steel smelting furnace with vertical gas burners in the crown." Dnepropetrovsk, 1961. 10 pp; (Ministry of Higher and Secondary Specialist Education Ukrainian SSR, Dnepropetrovsk Order of Labor Red Banner Metallurgical Inst imeni I. V. Stalin, Chair of Steel Metallurgy); 180 copies; price not given; (KL, 7-61 sup, 239)

ACCESSION NR: AP4041851 S/0139/64/000/003/0102/0107

AUTHOR: Kuchin, V. A.

TITLE: Frequency spectrum of ionic crystals of the CsCl type

SOURCE: IVUZ. Fizika, no. 3, 1964, 102-107

TOPIC TAGS: ionic crystal, crystal lattice oscillation, crystal lattice deformation, elastic deformation, Coulomb repulsion force, dipole force, cesium compound

ABSTRACT: The author reviews earlier research on the subject and indicates that the total spectrum of an ionic lattice of the CsCl type, under hydrostatic and isotropic pressure, was apparently not investigated heretofore. General formulas are therefore derived for the frequencies of the normal modes of this lattice, as functions of the parameter of deformation of isotropic tension and compression. In addition, the frequency spectrum of the "free" lattice of CsI is

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ACCESSION NR: AP4041851

calculated and some limiting frequencies are considered as functions of the deformation parameter. The non-Coulomb interaction was taken into account only between nearest neighbors, the ions were considered as point charges, the behavior of the frequency spectrum was considered for symmetrical directions (100), (110) and (111) of the wave vector, and the interaction between two ions is approximated by the Born two-term formula. The coefficients of the Coulomb interaction and the dipole sums are also evaluated. Orig. art. has: 1 figure, 6 formulas, and 3 tables.

ASSOCIATION Sibirskiy fiziko-tekhnicheskiy institut pri Tomskom gosuniversitete imeni V. V. Kuyby*sheva (Siberian Physicotechnical Institute at the Tomsk State University)

SUBMITTED: 23Mar63 ENCL: 00

SUB CODE: SS NR REF SOV: 002 OTHER: 004

Card 2/2

ANDON'YEV, S.M.; GLAZKOV, P.G. [deceased]; KUCHIN, V.A. KONDRAT'YEV, Ye.M.; LEVITASOV, Ya.M.; MAKAROV, K.I.; PANKRATOV, P.V.; PEVNYY, N.I.; POKRAS, L.M.; POCHTMAN, A.M.; TESNER, P.A.; SHEYNFAYN, F.I.; SHKLYAR, T.I.; Prinimali uchastiye: BERMAN, M.N.; VARFALOMEYEV, F.L.; ROBIN, M.A.; MOYSIYEVICH, G.I.; SAPIRO, V.S.; ALEKSEYEV, L.M.; POPOVA, R.S.

Heating Martin furnaces with natural gas using reformers. Gaz. prom. 9 no.11:14-17 '64. (MIRA 17:12)

KUCHIN, V.A.

Frequency spectrum of ionic crystals of the CsCl type. Izv. vys. ucheb. zav.; fiz. no. 3:102-107 '64. (MIRA 17:9)

1. Sibirskiy fiziko-tekhnicheskiy institut pri Tomskom gosudarstvennom universitete imeni Kuybysheva.

KUCHIN, V.D.

VOROB'YEV, A.A., professor, doktor fiziko-matematicheskikh nauk; VOROB'YEV, N.I., dotsent, kandidat tekhnicheskikh nauk; TRESKINA, M.N., inzhener; VOROB'YEV, G.A., inzhener; KALYATSKIN, I.I., inzhener; TRUBITSYN, A.M., inzhener; DMITREVSKIY, V.S., inzhener; KALGANOV, A.F., inzhener; KUCHIN, V.D., inzhener.

"High voltage electrical engineering." Part I and II. A.A.Akopian and others. Reviewed by A.A.Vorob'ev and others. Elektrichestvo no.8: 91-92 Ag '54 (MLRA 7:8)

1. Kafedra tekhniki vysokikh napryazheniy i kafedra elektroizolyatsionnoy i kabel'noy tekhniki Tomskogo politekhnicheskogo instituta im. Kirova.
(Electric engineering) (Akopian, A.A.)

KUCHIN, V D

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1675
AUTHOR VOROB'EV,A.A., KUČIN,V.D.
TITLE On the Problem of the Radiation of Dielectrica in Strong Electric Fields.
PERIODICAL Žurn.techn.fis,26, fasc.11, 2516-2517 (1956)
Issued: 12 / 1956

On the basis of the examination of the absorption spectra and the photoconductivity of ion crystals it may be assumed that on the occasion of the transition of electrons from the conductivity zone to the ground zone, quanta of energies of up to 10 eV can be radiated. The investigation of the radiation occurring in a strong electric field on the occasion of the recombination of the electron or of its transition into other states with low energy might contribute towards explaining those physical phenomena which take place in a dielectricum before breakdown.
Between 1953 and 1955 the authors tried to study the electroluminescence and electrophotoluminescence of samples of polistirol, plexiglass, and of NaCl-, KCl- and KBr crystals in strong electric fields. The sample in transformer oil, xylol, or air was exposed to the action of high parallel voltages, alternating voltages, and voltage pulses (1,5/40 microseconds). The attempt was made to determine the expected radiation visually, photographically, or by means of a quantum counter. The lowest sensitivity limit of the quantum counter used in this case was ~ 3000 Å and the sensitivity of the counter increased with a decrease of the wave length of the radiation. At voltages of up to 88% of the

Žurn.techn.fis,26,fasc.11, 2516-2517 (1956) CARD 2 / 2 PA - 1675

breakdown voltage no ultraviolet or Roentgen radiation of the solid dielectrica was noticed that might have been caused by the strong electric field.

The results obtained by these tests concerning the luminescence of crystals in strong fields are apparently in agreement with the ideas governing the theory of radiationless transitions of electrons. The construction used here for the sample makes it possible to measure the electric power of resistance of solid dielectrica in an inhomogeneous field. The maximum field strength on the spherical surface of the electrode (a point with the radius of curvature r) was determined by means of the formula $E = U/\varepsilon r$. Here U denotes the voltage, and ε - the dielectricity constant. For the disruptive field strength of mineral salt the authors obtained E_{disr} = 1 to 1,63 megavolt/cm.

INSTITUTION:

SOV/112-58-2-1857

Translation from: Referativnyy zhurnal, Elektrotekhnika, 1958, Nr 2, p 9 (USSR)

AUTHOR: Vorob'yev, A. A., Vorob'yev, G. A., and Kuchin, V. D.

TITLE: Methods for Determining Solid-Dielectric Breakdown Voltage in a Non-Uniform Field (O metodike opredeleniya probivnogo napryazheniya tverdykh dielektrikov v neodnorodnom pole)

PERIODICAL: Izv. Tomskogo politekhn. in-ta, 1956, Vol 91, pp 193-195

ABSTRACT: Breakdown voltage $U_{пр}$ and its dependence on external factors in breakdown of plate-shaped solid dielectrics in a non-uniform field are determined by properties of the ambient medium; it is not a characteristic of the solid dielectric proper. To eliminate the influence of ambient medium, it is suggested that a pit be drilled in the solid-dielectric sample. NaCl, KCl, KBr, KI, and plexiglass crystals were punctured. $U_{пр}$ of samples with conic pits was found to be higher than that of plates. Implies $U_{пр}$ with negative polarity on the point is considerably higher than that with positive polarity. The higher the lattice energy, the higher is $U_{пр}$. The above suggested sample

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SOV/112-58-2-1857

Methods for Determining Solid-Dielectric Breakdown Voltage in a Nonuniform Field

shape permits measuring the electric strength E_{op} of very thick solid dielectrics as $E_{op} = U_{rp}/\mathcal{E}r$, where $\mathcal{E}$ is permittivity of the dielectric; r is radius of the round tip of the point electrode. For NaCl 10-17 mm thick with DC voltage, $E_{op} = 1.01 - 1.625$ Mv/cm. Bibliography: 3 items. Tomskiy politekhnich. in-t (Tomsk Polytechnic Institute), Tomsk.

A.A.V.

Card 2/2

SOV/112-58-2-1872

Translation from: Referativnyy zhurnal, Elektrotekhnika, 1958, Nr 2, p 12 (USSR)

AUTHOR: Vorob'yev, A. A., and Kuchin, Y. D.

TITLE: On the Problem of Luminescence of Liquid and Solid Dielectrics in Strong Electric Fields (K voprosu o svechenii zhidkikh i tverdykh dielektrikov v sil'nykh elektricheskikh polyakh)

PERIODICAL: Izv. Tomskogo politekhn. in-ta, 1956, Vol 91, pp 385-389

ABSTRACT: It has been assumed that, similarly to semiconductor phosphors, liquid and solid dielectrics should glow in a strong electric field because of electron transition from the conductance region to the base region. Surface luminescence of transformer oil in a uniform field has been observed at 13 kv/mm(?) with the high-voltage electrode in air and at 28 kv/cm with both electrodes in oil. A photofilm with a sensitivity of 130 units has been lighted in the 3.3 kv/cm field. Luminescence of polysterene, plexiglass, and NaCl, KBr, and KCl crystals in a nonuniform field has been studied. A specimen shape has been developed that permits application of test voltages up to 100 kv.

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On the Problem of Luminescence of Liquid and Solid Dielectrics in Strong . . . .

Maximum field strength at the end of a point electrode has reached 1.3 Mv/cm and has been determined from the formula $E = U/\varepsilon r$, where ε is dielectric permittivity, r is the curvature radius of the point. The specimen was placed in air, as there was no other suitable transparent medium available. The voltages used were DC, AC, and 1.5/40 microseconds impulse. In 0.7-1.3 Mv/cm fields, NaCl, KCl, and KBr crystals emitted visible light; no ultraviolet or x-ray radiation was detected. It is assumed that when the electron travels from the conductance region to the base region, it delivers its energy to the lattice in relatively small portions, less than 0.1 ev. Bibliography: 14 items. Tomskiy politekhnich. in-t (Tomsk Polytechnic Institute), Tomsk.

A.A.V.

Card 2/2

KUCHIN, V.D.

20-2-18/60

AUTHOR: Kuchin, V. D.

TITLE: The Dependence of the Electric Strength of Ion Crystals Upon the Temperature (Zavisimost' elektricheskoy prochnosti ionnykh kristallov ot temperatury)

PERIODICAL: Doklady Akademii Nauk SSSR, 1957, Vol. 114, Nr 2, pp.301-303 (USSR)

ABSTRACT: With the aid of an electronic oscillograph the author of the paper under review determined the electrical strength of monocrystals of NaCl, KBr, KCl, and KJ in the temperature interval between -130° and $+150^{\circ}$ at constant voltage and at impulses of a duration of (10^{-4} to 10^{-8}) sec. At their thinnest place (where the puncturing took place) the samples were of a thickness of 150 μ. The dimple in the sample and the side opposite to it were coated in vacuum with vaporized tin. The puncturing took place at the front of the current shock. The results of the measurements of the electric resistance of NaCl at different temperatures at constant voltage and at the impulse of a duration of (10^{-4} to 10^{-7}) sec are compiled in a diagram contained in the paper under review.

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The Dependence of the Electric Strength of Ion Crystals Upon the Temperature

When the temperature increases, the electric resistance also increases up to a maximum and then again quickly decreases. The position of the maximum depends on the duration of the impulse. Analogous results are obtained also for KCl, KBr and KJ. The temperature dependence, as shown in the diagram, and the existence of the maximum are satisfactorily explained by the theory devised by H. Froehlich. If the application of the voltage lasts for $(1,1 \text{ to } 3,1).10^{-8}$ sec, then the electrical resistance of the ion crystals mentioned does not depend on the temperature and it is almost twice as high as with impulses of a duration of 10^{-6} sec. This independence from the temperature at ultrashort impulses is in no agreement, neither quantitatively nor qualitatively, with any of the existing theories of puncturing of solid dielectric substances. It is possible that the dielectric substance is mechanically destroyed by the effects of the strong electrical field. Another diagram contained in the paper under review shows the voltsecond characteristics for NaCl at different temperatures. At a duration of the voltage of 10^{-6} sec the electric strength is lower than at lasting application of the voltage; this can be explained by the effects of the

The Dependence of the Electric Strength of Ion Crystals Upon the Temperature

space charge. The increase in the velocity of development of the discharge when the temperature increases can be explained by an increase in the free length of path of the electrons There are 4 figures, and 7 references, 5 of which are Soviet

ASSOCIATION: Tomsk Polytechnical Institute imeni S. M. Kirov (Tomskiy politekhnicheskiy institut im. S. M. Kirova)

PRESENTED: December 28, 1956, by A. F. Ioffe, Academician

SUBMITTED: November 22, 1956

AVAILABLE: Library of Congress

Card 3/3

KUCHIN, V. D.

Kuchin, V. D. [Tomsk, Politekhnicheskiy Institut (Polytechnical Institute)]
Temperature Dependency of the Electrical Stability of Ionic Crystals
With Respect to Electrical Breakdown

(The Physics of Dielectrics; Transactions of the All-Union Conference on the Physics of Dielectrics) Moscow, Izd-vo AN SSSR, 1958. 245 p. 3,000 copies printed.

This volume publishes reports presented at the All-Union Conference on the Physics of Dielectrics, held in Dnepropetrovsk in August 1956 sponsored by the "Physics of Dielectrics" Laboratory of the Fizicheskiy Institut imeni Lebedeva AN SSSR (Physics Institute imeni Lebedev of the AS USSR), and the Electrophysics Department of the Dnepropetrovskiy gosudarstvennyy universitet (Dnepropetrovsk State University).

KUCHIN, V. D. Cand Tech Sci -- (diss) "~~The disruptive discharge~~ in crystalline ionic dielectrics at various temperatures and various durations of the application of ~~tension~~." Tomsk, 1958. 9 pp (Min of Higher Education USSR. Tomsk Order of Labor Red Banner Polytechnic Inst im S. M. Kirov), 100 copies (KL, 13-58, 96)

KUCHIN, V.D.

Intercollegiate conference on dielectrics and semiconductors. (MIRA 11:9)
Izv. vys. ucheb. zav.; fiz. no.3:168-174 '58.
(Dielectrics--Congresses) (Semiconductors--Congresses)

SOV/142-58-4-27/30

AUTHOR: Kuchin, V.D., Engineer

TITLE: Inter-Vuz Conference on Solid Dielectrics and Semi-Conductors (Mezhvuzovskaya Konferentsia po tverdym dielektrikam i poluprovodnikam)

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy - Radiotekhnika, 1958, Nr 4, p 516 (USSR)

ABSTRACT: From February 3 to 8, 1958, an inter-vuz conference was held in the Tomsk Politechnical Institute on solid dielectrics and semi-conductors. Members from 14 universities, 10 research institutes and 11 plants, from 14 cities throughout the USSR attended. The work was carried out in 6 sections. Together, 86 papers were given on methods of research into dielectrics and devices, research into the nature of punctures, polarization, losses and conductivity in dielectrics, the creation of scientifically conditioned technological processes when preparing the p-n junction as the working out of the theory of semi-conductors and dielectrics.

Card 1/2

Inter-Vuz Conference on Solid Dielectrics and Semi-Conductors

SOV/142-58-4-27/30

trics.

SUBMITTED: March 24, 1958

Card 2/2

AUTHOR: Kuchin, V. D., Candidate of Technical Sciences 30V/105-58-7-22/32

TITLE: Conference on Solid Dielectrics and Semiconductors (Konferentsiya po tverdym dielektrikam i poluprovodnikam)

PERIODICAL: Elektrichestvo, 1958, Nr 7, pp. 83 - 84 (USSR)

ABSTRACT: The intermediate university conference was held from February 3rd to 8th, 1958, in the Tomsk Polytechnical Institute (Tomskiy politekhnicheskiy institut). Representatives of 12 universities, 10 scientific research institutes, and 11 plants of 14 towns attended this conference. 83 reports were delivered. The work of the conference was carried out in 6 sections. In the section of semiconductors spoke: Professor Yu.G.Tolstov (ENIN AS USSR, Moscow) about a new method for the determination of the work parameters in germanium power valves without destruction of the latter. Docent A.F. Gorodetskiy and Docent S.S.Gutin (Novosibirsk) found a temporary instability of the resistance in thin tellurium layers and a satisfactory stability of the germanium-and bismuth resistance. Docent G.A.Katayev and L.N.Rozanov (Tomsk University) reported on the mechanism of heterogeneous reactions which occur

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under the participation of solid bodies. A.R.Zasypkina (SFTI) reported on the good rectifier properties of the silver-polystyrene varnish-germanium- and the mercury-KCl-germanium system.D.K. Vesnovskiy and others, Novosibirsk Institute of Electrical Engineering (Novosibirskiy elektrotekhnicheskiy institut) developed automatic semiconductor devices with flat germanium triodes and photoresistances as transmitters. V.F.Sinorov (SFTI) reported on the experiments which confirm the existence of the surface acceptor level and the surface conductivity in compounds of the type $A^{II}B^{IV}$. Ye.I.Cheglokov and A.M.Vaysberg (SFTI) investigated the "bond lattice" and found that the effective mass of the light hole increases with the increase of the ionic component in the bond and becomes anisotropic. V.N.Vertoprakhov (SFTI) reported on a new method for the detection of the crystallographic planes from the discharge figures on the germanium surface. A.P.Vyatkin (SFTI) investigated the rules governing the wetting of germanium with indium in dependence on the surface treatment of indium, the crystallographic orientation of germanium, and the heat maintenance in the case of melting. V.A.Chaldyshev investigated the energetic spectrum on the basis of a lattice model in connection with the

sphalerite lattice. A.P.Izergin and others (SFTI) worked out a method for the breeding of germanium monocrystals with even distribution of the admixtures from the melt without melting pot. Yu.D.Lukantsever, Frunze Kirghiz Institute of Pedagogics (Kirgizskiy pedinstitut, Frunze) investigated the rules governing the dying down of the intensity of phosphorescence, photoconductivity, and the light sum in the phosphorus ZnS-Cu in an ideal crystal phosphorus. From an investigation of the temperature dependence of the photodielectric effect in the phosphorus ZnS-CuFe during excitation and in the case of long stages of dying down of the phosphorescence of the latter P.Ye.Ramazanov (SFTI) makes conclusions as to the relaxation character of the processes which cause this effect. I.G.Mel'nik, Novosibirsk Institute of Electrical Engineering, reported on a simple distribution chamber for a vacuum plant. Ye.I.Shuraleva, Irkutsk University (Irkutskiy universitet) reported on the investigation of the influence of the electric and thermal treatment in the case of pure rock salt crystals, as well as on the influence of different concentrations of an activator introduced into the phosphori NaCl.Ni according to the method of electrolysis on the formation processes of F-centers

Conference on Solid Dielectrics and Semiconductors SOV/105-58-7-22/32

and the storing of light sums under the action of X-rays.

ASSOCIATION: Tomskiy politekhnicheskiy institut (Tomsk Polytechnical Institute)

1. Dielectrics--USSR 2. Semiconductors--USSR 3. Conferences

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AUTHOR: Kuchin, V. D., Candidate of Technical Sciences SOV/105-58-7-23/32

TITLE: Conference on Solid Dielectrics and Semiconductors (Konferentsiya po tverdym dielektrikam i poluprovodnikam)

PERIODICAL: Elektrichestvo, 1958, Nr 7, pp. 84 - 85 (USSR)

ABSTRACT: The conference took place from February 3rd to February 8th, 1958, in the Tomsk Polytechnical Institute, Section of Polarization, Losses, and Conductivity. B.I.Vorozhtsov, Candidate of Technical-Mathematical Sciences (SFTI) spoke about a simple circuit for the measurement of tg δ of from $1 \cdot 10^{-4}$ to 1 and of the capacitance of from 5 to 20 pF. The accuracy of measurement was 10% in the case of tg δ and 5% in the case of the capacity. Professor G.A.Smolenskiy and others (Institute of Semiconductors AS USSR) investigated the possibility of obtaining multicomponent systems from oxygen oxides without investigation of the state diagrams of the latter. I.S. Filatov (SFTI) investigated tg δ and ε of several ceramic materials in fields of from 180 - 4600 V/cm in the frequency range of from 7,65 - 20,5 megacycles and in the temperature range of from

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20 - 720°C according to the calorimetric method. Ionization-, relaxation-, and conductivity losses were found to occur. V.M. Nesterov (SFTI) measured by means of the wave guide method the conductivity, the dielectric permeability, and the losses of the "fluoroplast", polyethylene, "vinyloplast" etc. at from -80 - +100°C and 10^6, 10^7, 5.10^8 and 5.10^9 cycles. S.F.Ryabochenko, Irkutsk university (Irkutsk University) in the range of from 20 to 140°C found two temperature maxima of tg δ of the alkali halide crystals which are connected with the hydroscopy of the latter. I.G.Vorozhtsova (SFTI) found relaxation maxima in muscovite. They are assumed to be connected with the peculiarity of structure. Docent I.P.Tonkonogov and Ye.T.Nadirov (Karaganda Mining Institute) investigated the magnetic and electric heating of coals on the basis of the Maxwell-Wagner model. Docent Ye.K.Zavadovskaya (TPI) found that the character of the dependence of the electric conductivity of solid solutions on the composition in the case of temperature variation is determined by the interaction forces of the ions in the crystal. Docent K.N.Pogodayev and V.G.Stepanchenko (Irkutsk University) in the range of from 50 to 300°C found temperature maxima of the direct and reversible currents in natural nickel

or in nickel activated by ions or in the copper of rock salt. V.I.Gaman (SFTI) found that the temperature course of the pool factor in the case of silicate- and boron silicate glasses is to a considerable extent determined by the temperature dependence of the polarization potential in the case of the existence of a high-voltage polarization. Professor F.I.Kolomoytsev and A.Ya. Yakunin, Dnepropetrovsk University (Dnepropetrovskiy universitet) found the variation of the electric conductivity and the EMF induced by X-ray radiation by temperature and the intensity of the X-rays in polyethylene, polystyrene, teflon, polymethylmethacrylate, mica, and other dielectrics. Docent Ya.N.Pershits (Pskov Institute of Pedagogics) and G.D.Tarasenko (North Ossetian Institute of Pedagogics, Ordzhonikidze) found that the character of the propagation of the F-center cloudlet and that of its mobility is changed in consequence of the primary coloration of the NaCl-, KCL-, KBr- and KJ crystals, whereas the electric conductivity of the ions of the samples is reduced irreversibly. N.M.Torbin (TPI) found that the X-ray absorption factor increases with increasing molecular weight of pressed alkali halide salts.

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ASSOCIATION: Tomskiy politekhnicheskiy institut (Tomsk Polytechnical Institute)

1. Dielectrics--USSR 2. Semiconductors--USSR 3. Conferences

Card 4/4

AUTHOR: Kuchin, V. D., Candidate of Technical Sciences SOV/105-58-7-24/32

TITLE: Conference on Solid Dielectrics and Semiconductors (Konferentsiya po tverdym dielektrikam i poluprovodnikam.n)

PERIODICAL: Elektrichestvo, 1958, Nr 7, pp. 85 - 85 (USSR)

ABSTRACT: The conference took place from February 3rd to February 8th, 1958, in the Tomsk Polytechnical Institute, Section of Breakdown of Solid Dielectrics and Semiconductors. I.Ye.Balygin, Candidate of Technical Sciences (Leningrad), reported that from the calculation data of the resistance of the discharge channel and on the basis of the obtained oscillographs he could draw final conclusions concerning the dynamics of the development and the physical nature of the breakdown of titanium-containing ceramic material with ε=20. G.A.Vorob'yev (TPI), Candidate of Technical Sciences (TPI) constructed an oscillograph with pulse feeding. This oscillograph permits the reliable registration of phenomena of a duration of 10^{-9} sec. M.A.Mel'nikov (TPI) found that the electric strength and the time of lagging of the discharge in

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the breakdown of NaCl-, KCl-, KBr-, KJ crystals and methylmethacrylate crystals with pulses of a front length of $(5 - 7).10^{-9}$ sec are almost independent of the chemical composition. A.V. Astafurov (TPI) reported on voltage vs.time characteristics and the dependence of the breakdown voltage on the thickness in the electric breakdown of solid dielectrics of considerable thickness (2 - 34 mm). The applicability of the empiric formula of Gorev-Mashkileyson for the latter is shown. G.A.Andreyev (TPI) found by means of the double-ray oscillograph that the temperature dependence of the electrical strength on NaCl, KCl and KBr has a maximum in the case of a breakdown due to thermal instability in the range of room temperatures. V.D.Kuchin (TPI) found, proceeding from the single electron model, the dependence of the electrical strength on the temperature in the following form: $F^*(T) = kT/2e\lambda(T)$, where λ denotes the free length of path of the electron. K.K.Sonchik (TPI) found that the time of lagging of the discharge in the ion crystals is the shorter, the higher the excess voltage at the sample and the crystal lattice energy are. M.P.Tonkonogov and Ye.T.Nadirov (Karaganda Mining Institute) investigated the destruction of coal by an electrohydraulic shock.

The calculation showed that the discharge channel formed in the breakdown of the water is the source of the shock wave which destroys the coal. V.I.Obukhov (TPI) showed that the introduction of 0 - 10% solid powdery dielectrics into transformer oil, castor oil, glycerin, and distilled water influences to a very small extent the amount of the resistivity to electric pulses. The strength of the systems is to a great extent increased in the case of a content of admixtures of 30%.

ASSOCIATION: Tomskiy politekhnicheskiy institut (Tomsk Polytechnical Institute)

1. Dielectrics--USSR 2. Semiconductors--USSR 3. Conferences

AUTHOR: Kuchin, V. D., Candidate of Technical Sciences SOV/105-58-7-25/32

TITLE: Conference on Solid Dielectrics and Semiconductors (Konferentsiya po tverdym dielektrikam i poluprovodnikam)

PERIODICAL: Elektrichestvo, 1958, Nr 7, pp. 85 - 86 (USSR)

ABSTRACT: The conference took place from February 3rd to February 8th, 1958, in the Tomsk Polytechnical Institute (Tomskiy politekhnicheskiy institut), Section of Properties of Dielectrics. Professor A.A.Vorob'yev (TPI) reported on the great number of investigations in the theory of ionic dielectrics, of cystallization, of the mechanical and electric properties of dielectrics and practical insulation. He showed that the properties of the binary compounds are divided into two groups: the one group of properties increases with increasing lattice energy, the other is reduced. Docent M.S.Metsik, Irkutsk University (Irkutskiy universitet) developed a theory according to which the cleavage-work in mica crystals is composed of the work against the dipole forces and the work for the separation of the double layer and in the last stage results in an electrostatic mosaic. Docent M.I. Vorob'yev (TPI) reported on the results of the investigation of

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dielectric constant, of the losses, the electric strength, and the specific volume resistance under temperature influence, moisture, tropical conditions, in the corona products "fluoroplast-4", "fluoroplast-3", polyethylene, polymonochlorostyrene, "product-10", thermoreactive compounds, and urethane. M.S.Ivankina (TPI) measured the factor of linear expansion and the heat produced in the formation of solid solutions of the KCl- RbCl, KCl - KBr - and NaCl - NaBr system in dependence on the composition in the range of from 25 to 100° C. A. N.Kislina (TPI) found that the simple relations between the physical and chemical properties of the monocrystals of alkali-halide salts and their electrical strength (as described previously in the papers of A.A.Vorob'yev), are not always established in the case of solid solutions. Docent P.A.Savintsev and others (TPI) found that the strength of alkali-halide solutions determined according to the method of boring and mutual grinding increases with increasing molecular concentration its change according to its composition following a curve with a minimum. Docent V.V.Puchkovskiy, Chelyabinsk Institute of Mechanization and Electrification of Agriculture (Chelyabinskiy institut mekhanizatsii i elektrifikatsii sel'skogo khozyaystva) by means of experiments found that the dependence of the maximum

overheating temperature in the center of the small plate on the temperature of the surrounding air has maxima in the case of a change of this temperature of from 2o - 1oo° C.

Section of Ceramics: V.M.Belousov (TPI) gave a calculation of the ceramic structure. Docent V.A.Presnov and others (SFTI) reported on investigations of the vacuum-tight ceramic structure and the nature of the ceramic-metal boundary.

Section of Crystallization: Professor A.M. Kuz'min and assistants (TPI) dealt with geological problems. S.A.Stroitelev (TPI) gave a method for the selection of effective admixtures. A.P.Izergin developed a method and an equipment for the purification of liquids from small admixture quantities.

In the joint session of the sections concerned with the breakdown of solid dielectrics, ceramics, polarization, losses, and conductivity Professor N.I.Shishkin spoke about the "Electric Conductivity of Solidified Glasses". The final general meeting was opened by Ye.G.Papush (Dnepropetrovsk Institute of Railway Traffic Engineers) who reported on the "Foundations of the Theory of Polarons".I. Ye.Balygin and A.P.Rumyantsev reported on the investigation of the diffusion processes of the silver isotope

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Ag^{110} in amorphous and crystalline quartz, and in agglomerated oxides as Al_2O_3, ZrO_2 and TiO_2.

ASSOCIATION: Tomskiy politekhnicheskiy institut (Tomsk Polytechnical Institute)

1. Dielectrics--USSR 2. Semiconductors--USSR 3. Conferences

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Кучин, В. Д.

46-22-4-10/24

AUTHOR: Kuchin, V. D.

TITLE: Temperature Dependence of Dielectric Strength of Ionic Crystals in an Electric Disruption (Temperaturnaya zavisimost' elektricheskoy prochnosti ionnykh kristallov pri elektricheskoy forme proboya)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Seriya Fizicheskaya, 1958, Vol. 22, Nr 4, pp. 404-407 (USSR)

ABSTRACT: The correctness of a great number of existing theories of the electric breakdown of solid dielectrics is primarily classified from the viewpoint of the temperature dependence of dielectric strength. The temperature dependence of E_{pr} of ionic crystals as given by various theories, is different. For this reason it proves to be interesting to pursue the temperature course of E_{pr} of ionic crystals for the purpose of examining the correctness of the theory of breakdown, and to compare the results with the theoretical conclusions. The author measured the dielectric strength of NaCl, KCl, KBr and KJ at temperatures of from $-130 \div +150^{\circ}C$ at a constant voltage and with pulses with a duration of from $10^{-4} \div 10^{-8}$ sec. As can be seen from figure 1 (giving the dependence

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according to mean arithmetic values of E_{pr}) the dielectric strength of NaCl increases linearly with temperature up to 1,75 kV cm^{-1} $degree^{-1}$ at a constant voltage and a pulse duration of up to 10^{-7} sec in the temperature range below 0°C. Analoguous results were obtained from the salts KCl, KBr and KJ (figure 2). It is supposed, that the space charge in ionic crystals originates from ions, causing an increase of dielectric strength. Actually, the delay period of charge in a dielectric is of the order of magnitude of 10^{-8} sec (ref. 12) and the time elapsing until the space charge becomes manifest, exceeds 10^{-6} sec (figure 5). At a temperature rise, the number of ions forming a space charge increases. The increase of the dielectric strength of ionic crystals at $t = 10^{-8}$ sec, as compared to E_{pr} at pulses with a duration of 10^{-6} sec is connected with the discharge delay in the dielectric. The temperature dependence of E_{pr} at $t = 10^{-8}$ sec corresponds neither quantitatively nor qualitatively to any of the existing theories of breakdown in solid dielectrics. Apparently in this case a mechanical destruction of the dielectric occurs under the influence of a strong electric field without any preparatory processes.

Temperature Dependence of Dielectric Strength of Ionic Crystals in an Electric Disruption 48-22-4-10/24

It can be assumed that the mechanical effects in the crystal under the influence of the electric field will exceed its mechanical strength, and that the dielectric can be mechanically destroyed, if the voltage is from two to three times higher than the disruptive voltage. This assumption is still examined. The duration of voltage application must be taken into consideration in theoretical calculation of the representation of the temperature depenience of E_{pr}. Besides, the considerable effect of space charge at pulses of a duration exceeding 10^{-6} sec must be taken into consideration at temperatures above zero. The author expresses his gratitude to A. A. Vorob'yev for his help.
There are 5 figures and 15 references, 8 of which are Soviet.

ASSOCIATION: Tomskiy politekhnicheskiy institut im. S. M. Kirova
(Tomsk Polytechnical Institute imeni S. M. Kirov)

AVAILABLE: Library of Congress

Card 3/3 1. Crystals--Dielectric properties 2. Dielectric properties --Temperature factors 3. Electric fields--Ionizing effects

SOV/58-59-9-20519

Translation from: Referativnyy Zhurnal Fizika, 1959, Nr 9, p 147 (USSR)

AUTHOR: Kuchin, V.D.

TITLE: The Temperature Dependence of the Processes Accompanying the Electric Sparkover in Ionic Crystals

PERIODICAL: Izv. Tomskogo politekhn. in-ta, 1958, Vol 94, pp 36 - 38

ABSTRACT: On the basis of an analysis of published studies, the author maintains that in ionic crystals the statistical time of dischage delay is practically nil, and that the time of forming the discharge t_d can be adopted as the discharge time. Knowing t_d, it is possible to determine the average velocity of the propagation of the discharge as $\bar{v} = \bar{d}/\bar{t}_d$ (where $\bar{d}$ is the average thickness of the samples at the sparkover site). $\bar{t}_d$ can be determined from the discharge oscillogram. The dependence of $\bar{t}_d$ and $\bar{v}$ on the temperature T was plotted for crystals of NaCl, KCl, KBr and KJ in the temperature range from -200° to +200°C. For this purpose the author used the experimental results he had obtained earlier (RZhFiz, 1959, Nr 1, 1175). The resultant data agree satisfactorily with the consequences of Fröhlich's theory (H. Fröhlich, J.H. Simpson.

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The Temperature Dependence of the Processes Accompanying the Electric Sparkover in Ionic Crystals

SOV/58-59-9-20519

Advances in electronics, N.Y., 1950, Vol 2, p 185). When the time of applying the voltage equals $(1.2 \div 3.1) \cdot 10^{-8}$ sec, t_d decreases, while $\bar{v}$ increases with a reduction in the energy of the crystal lattice in the entire investigated range of temperature. The curves where $\bar{v} = \bar{v}(T)$ exhibit a maximum in the region of critical temperature T_k. These phenomena are explained in the following manner. When T rises, the constant of the crystal lattice increases, and consequently the length of the average free path of the electrons also increases. This leads to an increase in $\bar{v}$ when T rises. However, when $T > T_k$, the thermal vibrations of the ions increase sharply and $\bar{v}$ diminishes.

Yu.S.K.

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SOV/58-59-9-20520

Translation from: Referativnyy Zhurnal Fizika, 1959, Nr 9, p 147 (USSR)

AUTHORS: Vorob'yev, G.A., Kuchin, V.D.

TITLE: On the Nature of the Formation of the Space Charge in Ionic Crystals

PERIODICAL: Izv. Tomskogo politekhn. in-ta, 1958, Vol 94, pp 56 - 57

ABSTRACT: Measurements have shown that the electric resistance of ionic crystals increases with an increase in the duration of applying the voltage. This phenomenon is explained by the influence of the space charge that is formed. There exist various explanations of the effect of the space charge on the electric resistance of ionic crystals. The authors hold that the space charge is formed in ionic crystals on account of the flow of ions toward one of the electrodes. This is substantiated by the following calculation: electronic mobility in the air is 10^3 times greater than ionic mobility. If this ratio is also adopted for the case of NaCl, and if account is taken of the fact that the time of forming the charge (the electronic process) in samples of NaCl is of the order of 10^{-8} sec, then the time of forming the ionic space charge, under the

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On the Nature of the Formation of the Space Charge in Ionic Crystals

condition of the flow of ions through the thickness of the sample, must amount to 10^{-5} sec. According to the authors' data, the influence of the space charge begins at this time. The hypothesis concerning the ionic nature of the formation of the space charge is corroborated by a consideration of the exposure dependence of the electric resistance of NaCl at various temperatures.

M.N. Treskina

SOV/139-59-1-5/34

24(3)

AUTHOR: Kuchin, V.D.

TITLE: The Effect of Space Charge on Electric Strength of Ionic Crystalline Dielectrics (Vliyaniye ob"yemnogo zaryada na elektricheskuyu prochnost' ionnykh kristallicheskikh dielektrikov)

PERIODICAL: Izvestiya Vysshikh Uchebnykh Zavedeniy, Fizika, 1959, Nr 1, pp 30-34 (USSR)

ABSTRACT: The increase of electric strength of ionic crystalline dielectrics on increase of duration of action of applied voltage beyond 10^{-6} sec (Ref 1) has been ascribed to the effect of space charge (Ref 2). Space charge effects are suggested also by the higher electric strength under the simultaneous action of constant and pulse voltages of the same polarity, compared with the electric strength under pulse voltage conditions (Refs 3,4). The mechanism of formation of space charge in ionic crystalline dielectrics has been discussed by many workers (Refs 4-18), but there is no agreed view on the subject. The present author's view (Ref 2) is that this space charge is due to motion of ions towards the cathode. Negative space charge, due to passage of an electron current through the dielectric, is

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The Effect of Space Charge on Electric Strength of Ionic Crystalline Dielectrics

given by Eq (1). where ϵ and v are the charge and velocity of electrons, d is the dielectric thickness, and n_o is the initial number of electrons leaving the cathode. The electron motion induces a positive space charge, q_i, given by Eq (2). This positive space charge moves towards the cathode and limits the electron current. The resultant total space charge is predominantly due to ions and its density falls with the distance away from the cathode (Fig 1). The hypothesis of the ionic nature of space charge is confirmed also by experimental data shown in Fig 2. This figure shows a plot of electric strength of NaCl against the duration of application of the voltage (from 10^{-7} to 10^{-2} sec) at various temperatures. If the rate of motion of ions is taken to be 1000 times smaller than the rate of motion of electrons, then the time taken by an ion to travel through a dielectric of thickness of 0.15 mm is 10^{-5} sec. Fig 2 shows that the space charge effects do in fact appear at 10^{-5} sec. At $T = 0^{\circ}C$ and below it, the space charge effects are absent. Above $0^{\circ}C$ these effects are clearly present and

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The Effect of Space Charge on Electric Strength of Ionic Crystalline Dielectrics

increase with temperature. This is because detachment of ions is easier at higher temperatures and consequently larger space charges are produced. At 150°C and above, the space charge effects become smaller, possibly because part of space charge is dispersed by thermal motion of the lattice.

There are 2 figures and 21 references, of which 8 are Soviet, 9 English, 2 German, 1 Japanese and 1 Swedish.

ASSOCIATION: Nauchno-Issledovatel'skiy Institut Fiziki, Elektroniki i Avtomatiki pri Tomskom Politekhnicheskom Institut imeni S.M. Kirova (Physics, Electronics and Automation Scientific Research Institute at Tomsk Polytechnical Institute imeni S.M. Kirov)

SUBMITTED: May 16, 1958

KUCHIN, V.D.

More on the temperature dependence of the dielectric strength of ionic crystals. Fiz. tver. tela 1 no.3:450-455 Mr '59.
(MIRA 12:5)

1.Tomskiy politekhnicheskiy institut im. S.M. Kirova.
(Alkali metal halides--Electric properties)

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SOV/139-59-2-29/30

24.7160, 24.7300

AUTHORS: Boykov, G.P. and Kuchin, V.D.

TITLE: On the Problem of the Temperature Field in a Growing Crystal

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, 1959, Nr 2, pp 175-176 (USSR)

ABSTRACT: The authors suggest that the large scatter in experimental values of the electric strength of ionic crystals (Ref 1) is due to stresses produced during growth of these crystals. Mechanical deformations are produced in crystals because of thermal stresses due to non-uniform or too rapid cooling of these crystals. The authors derive an equation which gives the temperature field in a growing crystal (final radius R, length l)

$$T(r,Z) = T_f + (T_f - T_o) \times \sum_{n=1}^{n=\infty} A_n J_o(\mu_n \frac{r}{R}) \times \exp(-\mu_n \frac{Z}{R}) \frac{1-\exp(-2\mu_n \frac{l-Z}{R})}{1-\exp(-2\mu_n \frac{l}{R})} \quad (5)$$

On

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Temperature Field in a Growing Crystal

where r and Z are the radial and axial coordinates respectively, T_f and T_o are the ambient and melt temperatures respectively, λ is the thermal conductivity of the crystal, α is the heat transfer coefficient, μ_n are the roots of Eq (6) and A_n are given by Eq (7) (the values of μ_n and A_n may be taken from Lykov's work Ref 11). There are 11 references, 7 of which are Soviet and 4 English.

ASSOCIATION: Tomskiy politekhnicheskiy institut imeni S.M.Kirova (Tomsk Polytechnical Institute imeni S.M.Kirov)

SUBMITTED: April 26, 1958

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24 2400

66597

SOV/139-59-3-5/29

AUTHOR: Kuchin, V.D.

TITLE: Breakdown of Solid Dielectrics in a Non-Uniform Field

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, 1959, Nr 3, pp 31-34 (USSR)

ABSTRACT: Experiments on breakdown of solid dielectrics in a non-uniform field are often made on samples in the form of plates, placed between two electrodes consisting of a point and a plane. This technique has a serious disadvantage in that breakdown in a solid is always preceded by a breakdown of the surrounding medium; this affects strongly the process of electrical failure in the solid. It was found that the electric strength of a dielectric measured in this way depends on the properties of the surrounding medium (Refs 1,2) since breakdown in a solid is due to edge discharges in the medium. To study the behaviour of a solid dielectric during breakdown in a non-uniform field, it is necessary to exclude the effect of the surrounding medium. This was done by Aleksandrov, Vorob'yev, Prikhod'ko and Kuchin (Refs 1, 2, 5). Using a new technique, described earlier by Vorob'yev and Kuchin (Refs 4, 6), the author studied the effect of temperature on the breakdown strength of NaCl in a non-uniform field.

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66697

30V/129-59-3-5/29

Breakdown of Solid Dielectrics in a Non-Uniform Field

Breakdown was produced by applying single voltage pulses (with the front rise-time of 10^{-6} sec) to samples held at temperatures from -70 to +180 °C. The results obtained are given in Figs 3 and 4 and they show clearly that the breakdown voltage (40-60 kV) is independent of temperature and polarity of the pulse. The author discusses also the effect of temperature on the crystallographic direction of the breakdown channel. According to Davisson (Ref 7) the discharge should travel along a random crystallographic direction at low temperatures when the vibrations of ions in the lattice affect but slightly the electron motion. At higher temperatures the direction [100] was found to be most favourable and with a further rise of temperature the directions [110] and [111] become successively most favourable. It is difficult to find a theoretical basis for this situation. Theory predicts that the direction of the discharge channel should change with rise of temperature as follows: [random or 100] → [111] → [100 or 110] → [100] . The direction [111] for NaCl should predominate at temperatures of -50 to +15 °C. The author found (Ref 11) that, when the pulses had negative polarity, breakdown always occurred along the direction [100] .

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Breakdown of Solid Dielectrics in a Non-Uniform Field

When positive pulses were used the following sequence of breakdown directions was observed with rise of temperature: [110] -> [100 or 110] -> [110 or 111] . The experimental results obtained on NaCl by other workers (Refs 3,7,9-12) are given in Table 1. This table shows very considerable differences between the experimental results of different workers. The results obtained by the author on crystallographic directivity of the breakdown channel in NaCl are in good agreement with the work published by Cooper et al (Ref 10) but they did not confirm predictions made by Davisson (Ref 7), Callen (Ref 8) and others. The fact that breakdown does occur along the [110] direction shows that fast electrons are responsible for breakdown. Since the breakdown voltage is independent of the pulse polarity it may be assumed that the positive space charge manages to disperse under the action of a high-intensity field at the space charge boundaries. Lack of dependence of the breakdown voltage on temperature suggests that at low non-uniform field intensities temperature does not affect the electric strength and the breakdown voltage is determined primarily by the radius of

Breakdown of Solid Dielectrics in a Non-Uniform Field

the point electrode (Ref 5). It follows that it is not possible to find the effect of temperature on the breakdown voltage of ionic dielectrics in non-uniform fields. Acknowledgements are made to Professor A.A. Vorob'yev and Candidate of Technical Sciences A.M. Trubitsyn for their advice.
There are 4 figures, 1 table and 12 references, 6 of which are Soviet and 6 English.

ASSOCIATION: Nauchno-issledovatel'skiy institut yadernoy fiziki pri Tomskom politekhnicheskom institute imeni S.M. Kirova (Nuclear Physics Scientific Research Institute at Tomsk Polytechnical Institute imeni S.M. Kirov)

SUBMITTED: August 12, 1958

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S/139/59/000/06/016/034
E201/E191

24,2400

AUTHOR: Kuchin, V.D.

TITLE: Some Results of an Investigation of Breakdown in Ionic Crystalline Dielectrics in Vacuo

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, 1959, Nr 6, pp 107-111 (USSR)

ABSTRACT: To avoid possible secondary effects it is best to measure the electric strength in vacuo. Such vacuum measurements were carried out, for example, by A.K. Krasin (Ref 2). The present author also carried out his measurements in vacuo using an instrument whose construction was suggested by Professor A.A. Vorob'yev. The instrument is in the form of a glass bulb (Figs 1, 2). The upper part of the bulb has a reservoir which can be filled with liquid air when the sample is being cooled, or with some other liquid when heating is required. This reservoir serves also as the high-voltage electrode. Both electrodes were made of silver. The bulb with the sample (an ionic dielectric crystal) was evacuated until a pressure of 3-5 x 10-6 mm Hg was reached. After evacuation the sample was cooled or heated to the required temperature. The temperature was measured on the side opposite to the reservoir, using

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Some Results of an Investigation of Breakdown in Ionic Crystalline Dielectrics in Vacuo

a thermistor connected to a bridge circuit. The vacuum system employed was such that it coped with gas evolution from the bulb walls and from the sample, as well as with any leaks into the system. The whole apparatus is shown schematically in Fig 3, and its photograph is given in Fig 4. The prototype of the apparatus was constructed at the Radiophysics and Electronics Institute of the Siberian Division of the Academy of Sciences, USSR. Fig 5 gives the results of measurements of the electric strength of rocksalt at four temperatures between +25 and -70 °C, at pressures not greater than 5×10^{-6} mm Hg. The electric strength was measured using pulses with a rise time of 10^{-6} sec. Fig 5 shows that the electric strength of NaCl rises with temperature: at -70 °C it is ~ 0.8 MV/cm, and at +25 °C it is 1.1 MV/cm. Lowering of the electric strength with fall of temperature is not due to "loosening" of the sample surface by freezing of absorbed moisture. The scatter in the values of the electric strength measured

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Some Results of an Investigation of Breakdown in Ionic Crystalline Dielectrics in Vacuo

in vacuo is considerably smaller than when these measurements are carried out on an insulating medium at atmospheric pressure. This small scatter is probably due to the absence of secondary effects (caused by the presence of a liquid insulating medium, the effect of the electrode material, variations of air pressure, etc). During breakdown in vacuo NaCl and other ionic crystals emit visible and ultraviolet electroluminescence (Ref 5). Calculations show that direct ionization by electric fields will occur near the cathode in a layer not thicker than 1 μ. Since electroluminescence is observed throughout the dielectric, direct ionization cannot account for the emitted radiation. The author suggests that electroluminescence is due to collision ionization by conduction electrons. Due to such ionization, the electric field in the crystal will be affected by an ionic space charge lying near the cathode (Ref 6). This space charge is accompanied by intense luminescence, especially in the cathode region. Electroluminescence was observed also on breakdown in an insulating liquid at atmospheric pressure.

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E201/E191

Some Results of an Investigation of Breakdown in Ionic Crystalline Dielectrics in Vacuo

In this case luminescence is weaker than in vacuum, since some of the radiation is absorbed by the insulant (Ref 8). Experiments on breakdown of KCl and KBr crystals showed that their room-temperature electric strength in vacuo is somewhat lower than the electric strength measured at atmospheric pressure, but the difference lies within the experimental error. The breakdown channel temperature in the ionic crystals which failed in vacuo is 3-4 times smaller than when breakdown occurs at atmospheric pressure. It was also found that when pressure in the bulb was greater than 10^{-5} mm Hg, surface flashover occurred, and the flashover voltage rose with permittivity of the crystal. Fig 6 shows this for NaCl, KCl, KBr, KI, whose flashover voltages decrease in the above order from ~11 to ~7 kV. There are 6 figures and 8 references, of which 6 are Soviet and 2 English.

Card 4/4

ASSOCIATION: NII Tomskogo politekhnicheskogo instituta imeni S.M. Kirova (NII, Tomsk Polytechnical Institute imeni S.M. Kirov)

SUBMITTED: January 21, 1959

KUCHIN, V.D.

PHASE I BOOK EXPLOITATION SOV/4809

Vorob'yev, A.A., G.A. Vorob'yev, E.I. Vorob'yev, A.F. Kalganov, I.I. Kalyatskiy, V.D. Kuchin, G.A. Mesyats, S.P. Pokrovskiy, E.K. Somchik, and A.T. Chepikov

Vysokovol'tnoye ispytatel'noye oborudovaniye i izmereniya (High-Voltage Testing Equipment and Measurements) Moscow, Gosenergoizdat, 1960. 583 p. Errata slip inserted. 10,500 copies printed.

Ed. (Title page): A.A. Vorob'yev, Professor; Ed. (Inside book): A.I. Dolginov; Tech. Ed.: K.P. Voronin

PURPOSE: This book is intended as a textbook for students taking courses dealing with high-voltage technique and high-voltage testing equipment. It may also be of use to the personnel in high-voltage laboratories and scientific institutions. New data contained in the book may be of interest to electricians.

COVERAGE: The book describes methods and installations used for generating and measuring high and superhigh constant, alternating, and pulse voltages used in laboratory work and in charged-particle acceleration processes. Some data contained in the book could be used in designing and computing high-voltage installations. The book was written by the staff members of the Department of High-Voltage Technique of the Tomsk Polytechnic Institute. Chapters I and II were written by A.A. Vorob'yev, with paragraphs I-1 and I-2 written jointly with

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I.I. Kalyatskiy, paragraph I-4 with E.I. Vorob'yev, paragraphs II-1 to II-6 and II-10 to II-13 with A.F. Kalganov, and paragraphs II-7 to II-9 with V.D. Kuchin. Ch. III was written by A.A. Vorob'yev, with the exception of paragraph III-4, written by S.P. Pokrovskiy and paragraph III-6, written jointly by A.A. Vorob'yev and the latter. Ch. IV: paragraphs IV-1 to IV-3 were written by I.I. Kalyatskiy; paragraphs IV-5 and IV-6 by A.A. Vorob'yev; paragraph IV-4 by A.A. Vorob'yev and I.I. Kalyatskiy jointly; paragraph IV-7 by E.K. Somchik; paragraph IV-8 by G.A. Mesyats; and paragraphs IV-9 and IV-10 by E.I. Vorob'yev. Ch. V: paragraphs V-1, V-2 and V-12 were written by A.A. Vorob'yev; paragraphs V-3, V-4 and V-8 by A.A. Vorob'yev and G.A. Vorob'yev jointly; paragraphs V-5 to V-7 by A.A. Vorob'yev and A.T. Chepikov jointly; paragraphs V-9 to V-11 by A.A. Vorob'yev; and paragraph V-13 by E.K. Somchik. The authors thank Engineer L.T. Murashko for his assistance. References accompany each chapter.

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8(S/143/60/000/02/006/018
D043/D002

AUTHOR: Kuchin, V.D., Candidate of Technical Sciences

TITLE: On the Theory of the Influence of Electrode Surface Irregularities on the Puncturing Voltage

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Energetika, 1960, Nr 2, pp 45-50 (USSR)

ABSTRACT: The author discusses the electrical field between two spheres, one of which has a cylindrical projection. Calculations of Ya. I. Frenkel' / Ref. 2 / and others show that the presence of such a cylindrical projection on the surface of a sphere must reduce the puncturing voltage of a sphere gap. According to available formulas, it is impossible to determine the field intensity close to the spike, since the value E_{av} remains unknown. There is a considerable difference between theoretical and experimental data,

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On the Theory of the Influence of Electrode Surface Irregularities on the Puncturing Voltage

because the theories used for this purpose do not account for the space charge. The space charge originates during the corona discharge in the sphere gap when free electrons are captured by neutral air molecules. The existing theories have no explanation for the fact that the puncturing voltage is higher with a positively charged projection, or if the latter is short. The author attempts to explain this phenomena by the pecularities of space charge formation. There are 4 graphs and 6 references, 3 of which are Soviet, 1 German, 1 English and 1 Czech.

ASSOCIATION: Tomskiy ordena Trudovogo Krasnogo Znameni politekhnicheskiy institut imeni S.M. Kirova (Tomsk - Order of the Red Labor Banner - Polytechnic Institute imeni S.M. Kirov)

Card 2/3

S/143/60/000/02/006/018
D043/D002

On the Theory of the Influence of Electrode Surface Irregularities on the Puncturing Voltage

SUBMITTED: October 7, 1959, by the Seminar kafedry tekhniki vysokikh napryazheniy (Seminary of the Department of High Voltage Engineering)

Card 3/3

KUCHIN, V.D.

Breakdown criteria of solid dielectrics. Izv.vys.ucheb.zav.;fiz. no.2:161-162 '60. (MIRA 13:8)

1. Tomskiy politekhnicheskiy institut im. S.M.Kirova.
(Breakdown, Electric) (Dielectrics)

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S/139/60/000/03/020/045
E032/E314

AUTHOR: Kuchin, V.D.

TITLE: A Study of the Effect of Temperature on the Electrical Strength of Ionic Crystals

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, 1960, Nr 3, pp 117 - 118 (USSR)

ABSTRACT: An electron moving in an electric field F takes up an energy :

$$A = eF\lambda \qquad (1)$$

over a mean free path λ . On the other hand, the energy losses by the electron due to the interaction with the lattice can be expressed in terms of the wave vector $\underline{k}$ and is given by Eq (2). At low temperatures ($T < T_c$) the principal form of interaction of electrons with a crystal lattice is the loss of energy through phonons. It follows from the law of conservation of energy that the minimum wave vector $\underline{k}_o$ of an electron which is capable of scattering a phonon with a wave number p is given by Eq (3) (Ref 2). Substituting

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A Study of the Effect of Temperature on the Electrical Strength of Ionic Crystals

this formula into Eq (2) one finds that the minimum energy loss experienced by an electron on interaction with a lattice is given by Eq (4), where $\omega = p\nu$ and is the angular frequency of the phonon. Since for $T < T_C$ the phonon energy is roughly $3kT/2$, it follows that on substituting this value for $\hbar\omega$ in Eq (4) the final formula for the minimum energy loss is of the form given by Eq (5), where $a = \sqrt{2m^*\nu^2}$. It is clear from Eq (5) that as the temperature increases, the minimum electron energy which is necessary to transmit a phonon to the crystal lattice will increase (Figure 1). An equilibrium state will persist in the dielectric until the energy gained by the electron from the field will be smaller than the energy communicated by the electron to the lattice. If the energy gained by the electron is greater than that lost to the lattice, then a stationary state will be set up in the dielectric and this will lead to a breakdown. This

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A Study of the Effect of Temperature on the Electrical Strength of Ionic Crystals

means that the criterion for the breakdown is the equality of the gained and lost energies. Equating Eqs (1) and (5) one is led to Eq (6). This equation involves the mean free path of the electron. It is assumed that the mean free path is given by (Ref 1) $\lambda = C[a_o (T)]^3$ where C is a constant. It has been found experimentally that the linear expansion coefficient increases with temperature (Ref 3). Between 50 and 500 °K the dependence of the linear expansion coefficient on the temperature can be written down in the form $\alpha = K(T/T_n)^{1/4}$. Thus, as the temperature increases, the lattice constant a_o, i.e. the distance between the ions, will be proportional to α. If one determines the dependence of the lattice constant on the temperature, one can calculate the value of λ for different temperatures. It is found that it does not

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A Study of the Effect of Temperature on the Electrical Strength of Ionic Crystals

exceed 10^{-8} cm. If it is assumed that the packing of molecules in solids is 100 times denser than in gases then for gases λ_B is of the order of 10^{-6} and it is found that in fact (Ref 4) $\lambda_B = 6.2 \times 10^{-6}$ cm. It follows that the values of λ obtained for ionic crystalline dielectrics are close to the true values. Once λ and its dependence on temperature have been determined, the temperature dependence of the electrical strength of ionic crystals can be calculated from Eq (6) by the method of successive approximations. The relative change in the electrical strength of ionic crystals with temperature is shown in Figure 2.
There are 2 figures and 4 references, 2 of which are English and 2 Soviet.

4

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E032/E314

A Study of the Effect of Temperature on the Electrical Strength of Ionic Crystals

ASSOCIATION: Tomskiy politekhnicheskiy institut imeni S.M. Kirova (Tomsk Polytechnical Institute imeni S.M. Kirov)

SUBMITTED: Muly 29, 1959

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Card 5/5

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S/139/60/000/006/017/032
E032/E414

24.7500 (1043, 1145, 1160)

AUTHOR: Kuchin, V.D.

TITLE: On the Theory of Interaction of Moving Electrons With Lattice Vibrations

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, 1960, No.6, pp.113-115

TEXT: The problem considered by the present author is formulated as follows. Consider the interaction of electrons with each other and with the lattice vibrations and suppose that, owing to ionization by collision, n electrons are produced per unit volume of the dielectric, so that the number of free electrons at a time t is $N + n$. Any electron with a velocity v at an angle Ψ to the x-direction (direction of external electric field F) is given an additional velocity

$$v_1 = \epsilon F \tau m^{-1} \cos\Psi$$

by the electric field. The change in the velocity of the $N + n$ moving electrons, due to their collisions with lattice vibrations, can be found from the expression $v_2 = nv/3N$ (Ref.1).

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On the Theory of Interaction of Moving Electrons With Lattice Vibrations

The total change in velocity per unit time of an electron moving in the dielectric is then given by

$$v = \frac{1}{\tau}\left(v\cos\Psi + \frac{eF\tau}{m}\cos\Psi + \frac{1}{3}\frac{n}{N}v\right), \qquad (1)$$

Eq. (1)

where τ is the relaxation time. Let ω be the repetition frequency of plane waves characterizing a moving electron, or a beam of non-interacting electrons. The wave velocity v_o in the dielectric is then proportional to ω/k, where k is the wave number. All changes associated with the plane wave can then be looked upon as changes in some function $\exp\left[j(\omega t - kx)\right]$, where $\partial/\partial x = -jk$ and $\partial/\partial t = j\omega$.

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On the Theory of Interaction of Moving Electrons With Lattice Vibrations

In view of this we have

$$v = \frac{\left(v + \frac{\epsilon F \tau}{m}\right)\cos\Psi + \frac{1}{3}\frac{n}{N}v}{1 + j\omega\tau - j\kappa\lambda\cos\Psi}, \qquad (2)$$

Eq. (2)

where λ is the mean free path of an electron. The electron current density in the dielectric is then given by

$$= \frac{3Ne}{4\pi m}\frac{j\omega\tau(\epsilon F\tau + mv)}{j\omega\tau + f(E)}(1 + j\omega\tau)f(E). \qquad (3)$$

Eq. (3)

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E032/E414

On the Theory of Interaction of Moving Electrons With Lattice Vibrations

where $f(E) = 1 - \frac{1}{2}\int_{-1}^{1} \frac{1 + j\omega\tau}{1 + j(\omega\tau - 2\pi x)}\, dx$

The electron gas interacts with the lattice vibrations through elastic collisions in which the energy and momentum of the electron is reduced. The fraction of energy which an electron communicates to the lattice and which is transformed into heat is given by (A.B.Pippard, Ref.1)

$$\dot{Q} = \frac{3Nm}{4\tau}\int_{0}^{\pi} \Delta v^2 \sin\Psi d\Psi, \qquad (5)$$

Eq. (5)

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On the Theory of Interaction of Moving Electrons With Lattice Vibrations

where $\Delta v = v_2 - v_1$, and v_1 and v_2 are the electron velocities before and after collision with the lattice. As a result of ionization by collision, a "shower" is produced and the electrons forming this shower repel each other by the electrostatic forces acting between them. As a result, their paths are no longer straight lines. The equation of the trajectories is given by

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$$x = \frac{eF - \frac{1}{2}a^3\frac{\epsilon-1}{\epsilon+2}\operatorname{grad}F^2 + mg}{5(N+n)^2\left(\epsilon + 2F\frac{\epsilon-1}{2\epsilon}\right)^2}y^3 + \sqrt{\frac{mv^2}{(N+n)^2\left(\epsilon + 2F\frac{\epsilon-1}{2\epsilon}\right)^2}y^3},$$

Eq. C 115.

$$\operatorname{tg}\theta = \frac{(N+n)^2\left(\epsilon + 2F\frac{\epsilon-1}{2\epsilon}\right)^2}{4y^2\left(\epsilon F - \frac{1}{2}a^3\frac{\epsilon-1}{\epsilon+2}\operatorname{grad}F^2 + mg\right)},$$

where $g = 9.81$ m/sec^2 and a is a constant.

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E032/E414

On the Theory of Interaction of Moving Electrons With Lattice Vibrations

The breakdown of the dielectric is concluded by the formation of a highly conducting channel connecting the two electrodes. The shock-wave produced during charge neutralization in this channel is propagated with a velocity

$$v_y = c\sqrt{1 + \frac{\eta + 1}{2\eta}\frac{p_k}{p}}$$

where p_k is the pressure in the channel, p is the pressure to which the dielectric is subjected as a result of the application of the electric field, and η is the ratio of the thermal capacity of the channel to the thermal capacity of the dielectric. The shock-wave gives rise to a mechanical breakdown of the dielectric. There are 2 figures and 3 references: 1 Soviet and 2 non-Soviet.

ASSOCIATION: Tomskiy politekhnicheskiy institut imeni S.M.Kirova (Tomsk Polytechnical Institute imeni S.M.Kirov)

SUBMITTED: December 31, 1959

Card 7/7

KUCHIN, V.D.; SHASTOVA, A.K.

Induced electromotive force and dielectric strength of irradiated polyvinyl chloride. Vysokom. soed. 4 no.12:1863-1866 D '62. (MIRA 15:12)

1. Zaporozhskiy mashinostroitel'nyy institut imeni V.Ya. Chubarya.
(Vinyl compound polymers—Electric properties)
(Radiation)

S/196/63/000/003/004/012
A052/A126

AUTHORS: Boykov, G.P., Kuchin, V.D., Serykh, G.M.

TITLE: On the character of the temperature field of an irradiated solid dielectric

PERIODICAL: Referativnyy zhurnal, Elektrotekhnika i energetika, no. 3, 1963, 6, abstract 3B44. (Izv. Kurganskogo mashinostroit. in-ta, 1, 1962, 23 - 26)

TEXT: Using the elementary-balance method an analytical calculation is carried out of the temperature field in a solid dielectric subjected to ionizing irradiation. The expressions derived make it possible to determine the temperature distribution over the thickness of the lamella of the irradiated dielectric. There is 1 figure and 1 reference.

N. Torbin

[Abstracter's note: Complete translation.]

Card 1/1

KUCHIN, V. D.; VOLKOV, R. A.

"Physics course (Mechanics)" by M. M. Arkhangel'skii. Reviewed by V. D. Kuchin, R. A. Volkov. Izv. vys. ucheb. zav.; fiz. no.6:179 '62. (MIRA 16:1)

1. Zaporozhskiy mashinostroitel'nyy institut imeni V. Ya. Chubarya.

(Bibliography—Physics)
(Arkhangel'skii, M. M.)

ACCESSION NR: AP4025081 S/0139/63/000/006/0003/0007

AUTHOR: Kuchin, V. D.

TITLE: Space charge in solid dielectrics

SOURCE: IVUZ. Fizika, no. 6, 1963, 3-7

TOPIC TAGS: space charge, alkali halogen crystal, line of force, electric field intensity, dielectric constant

ABSTRACT: With a view to calculating the variation in the intensity of electric field in a solid dielectric in the presence of space charges and also the space charge distribution along the width of the dielectric, the electric field between a sphere and a plane was investigated by the author. The surface of the sphere was assumed to have microscopically small cylindrical protuberances of length l. At fields above the critical value ionization started near these protuberances, resulting in the ionic space charge in the dielectric. The mechanism of space charge production was dealt with by the author in an earlier work (V. D. Kuchin. Izv. vuzov SSSR, Fizika No. 1, 30, 1959). In the analysis of the present work it was assumed that the space charges caused a variation only in the magnitude of the electric field but that the configuration of the field remained unchanged.

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ACCESSION NR: AP4025081

Starting with equation 1, $\overline{\operatorname{div} E_0 = \rho/\varepsilon} \parallel \overline{\Delta\varphi_0 = \rho/\varepsilon}$, (1)
where E_o is the electric field, p the space charge density, ε the dielectric constant, and $\Delta\varphi_o$ the change in potential, expressions were obtained for E_o in terms of the interelectrode potential difference and the dimensions of the imperfections. For the very small imperfections, these were reduced to

$$E_0 = \frac{1}{(-x^2+2dx)}\left[\frac{2Ud}{\ln\frac{2d}{l}} + \frac{U_0-U}{1{,}4\,d^2}\left(\frac{x^3}{3} - dx^2 + \right.\right. \quad (2)$$

$$\left.\left. + \frac{d^3}{3\ \mathrm{Arth}\ \frac{d-x}{d}}\left(\ln\frac{d}{2l} - 4{,}5\right)\right)\right],$$

where U is the potential difference between the electrodes, d the interelectrode spacing, and l the length of the surface imperfections. For $U_o/d = 1.31 \times 10^6$ v/cm, $U/d = 0.98 \times 10^6$ v/cm (this is the case for rock salt at 100C) with l = 0.0001 cm, the numerical results from the above expression are plotted in Figure 1 of the Enclosure. Orig. art. has: 13 formulas and 2 figures.

ASSOCIATION: Zaporozhskiy mashinostroitel'nyy institut imeni V. Ya. Chubarya

Card 2/4

ACCESSION NR: AP4025081

(Zaporozhe Mechanical Engineering Institute)

SUBMITTED: 25Jun62 ENCL: 01

SUB CODE: EM NO REF SOV: 005 OTHER: 001

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ACCESSION NR: AP4025081

ENCLOSURE: 01

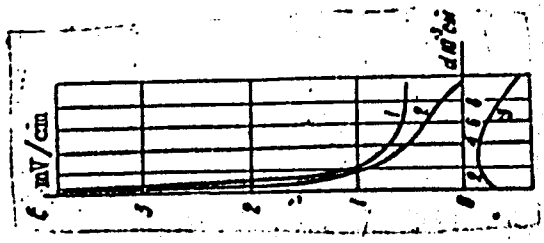

Fig. 1. Change of electric field intensity along the width of the dielectric. Curve 1 corresponds to the first term and curve 3 corresponds to the second term in equation (2). Curve 2 is the resultant field in the dielectric.

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VOLKOV, R.A.; KUCHIN, V.D.

Certain nonlinear problems in the theory of electroconductivity. Izv.vys.ucheb.zav.;fiz.no. 2:20-22 '64. (MIRA 17:6)

1. Zaporozhskiy mashinostroitel'nyy institut imeni V.Ya.Chubarya.